

EXPLANATION OF PLATE XLIX.

- Fig. 1. External female organs of virgin *Hyæna crocuta*, showing the orifice of the urinogenital canal situate upon the *extremity* of the glans clitoridis, both being included within the *single* chamber bounded by the prepuce. P, prepuce; U.G, orifice of the urinogenital canal.
2. External female organs of *H. crocuta* subsequent to parturition, lateral view. The figure shows that the urinogenital canal instead of opening upon the *extremity* of the glans clitoridis, as in the virgin, opens altogether *below* that body; and moreover that the extremity of the clitoris and the orifice of the canal are contained in *two* separate chambers included by the prepuce, and separated by the two portions of the frænum preputii. P, prepuce; C, clitoris; U.G, orifice of urinogenital canal.
3. The same, seen from the front. Externally is the prepuce, within which are included, in separate chambers, the clitoris above and the orifice of the urinogenital canal below.
4. Prostate gland of male *Hyæna crocuta*. VV, vasa deferentia. P, prostate gland. U, urethra.

3. On the Indian Species of the Genus *Mus*. By OLDFIELD THOMAS, F.Z.S., British Museum.

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(Plates L., LI.)

The following paper is an attempt to clear up the extreme confusion which exists with regard to the synonymy of the Indian species of the extensive genus *Mus*. How great this confusion is will have been evident to any one who has tried to affix the proper name to any Indian specimen of the genus; and it is hoped that the present account of the species, being founded almost entirely on the types, will be of use to collectors and others attempting to name an Indian rat or mouse in the future. The chief, and almost only general paper on the subject is one by the late Mr. E. Blyth, entitled "A Memoir on the Rats and Mice of India."¹ This memoir, which consists of a collection of references to all the Indian species, though extremely useful as giving a nearly complete list of all the previous descriptions, yet cannot be said to have added very much to our knowledge of the Indian rats and mice. Dr. Jerdon, in his 'Mammals of India,' accepted Blyth's determinations, and added but little on his own account. Dr. J. Anderson² has recently written a most useful paper on the species of the subgenus *Nesokia*, which will be referred to later on.

One of the chief causes of the existing confusion was the fact that Mr. B. H. Hodgson, formerly British Resident at Nepal, having made a most magnificent collection in that country, described, either himself, or through Dr. Horsfield of the India Museum, a large number of species of this genus in the briefest possible manner; so

¹ J. A. S. B. xxxii. p. 327 (1863).

² J. A. S. B. xlvii. p. 214 (1878).

that, the types being in England and the workers on the subject in India, an attempt had to be made to determine the species from the published descriptions, an almost hopeless task. It must, however, be said that other authors have not given in all cases the most perfect descriptions, many of those of Mr. Blyth himself being especially short and unsatisfactory. In all, there have been no less than ninety Indian species described, belonging, in my opinion, to only nineteen valid species, thus giving an average of more than four synonyms to every species.

In writing the present paper I have had the advantage of access to the following materials, which, including as they do the types of the greater part of the described species, may be looked upon as quite unequalled.

1. Full series of all the species collected and described by Mr. Hodgson in Nepal, some presented by him direct to the British Museum, others obtained through the India Museum, South Kensington.

2. The types of the Indian species described by the late Dr. J. E. Gray.

3. A most valuable collection of specimens in spirit from all parts of India, numbering about 130 individuals. This was presented by Mr. W. T. Blanford, and collected partly by the donor himself and partly by Mr. Mandelli (Darjiling), Col. St. John (Ajmere), the Rev. S. Fairbank (Ahmednagar), Col. R. H. Beddome (South India), and others.

4. A considerable series of skins lent to me for examination by Mr. Blanford, and similarly collected in all parts of India.

5. The specimens collected by Sir Walter Elliot in the Southern Mahratta country and other parts of South India, including the types of the species described by him.

6. Collections of greater or less extent made by Dr. J. Scully (Gilgit), Captain Hutton (Mussooree), Capt. Pemberton (Bhotan), Dr. Kelaart (Ceylon), Mr. H. Cuming (Ceylon), etc.

7. The collection of drawings of Nepalese species formed by Mr. Hodgson, and lent to me by this Society, with manuscript notes appended to nearly all of them. These notes are hereafter frequently referred to.

8. A collection of about 50 spirit specimens from various parts of India; presented to the British Museum by the Trustees of the Calcutta Museum¹.

Altogether I have examined about 450 Indian specimens. It will be seen by the asterisks prefixed to the names in the synonymy that, of the nineteen good species allowed here, we have the types of no less than thirteen, besides the types of all the four subspecies or

¹ This collection, kindly sent by Dr. Anderson, only arrived while the present paper was in the press; but it has nevertheless been of considerable service to me in confirming my results, the specimens being all named by Dr. Anderson, and being therefore very useful in helping the identification of those species of which the types are at Calcutta. The letter accompanying this collection is quoted in footnotes in several places below.

varieties, and also those of about forty species which are considered as synonyms.

With regard to what is here called "India," I have only taken the country west of the 90th degree of longitude, so as to exclude Assam and Burmah, as we have not yet sufficient material from these countries for me to work out the numerous species described from them. I hope, however, that Dr. Anderson or some one else to whom the Calcutta Museum is available, will work out these forms, the greater part of the species having been described by Mr. Blyth, and the types preserved there.

Before proceeding to a detailed account of the subgenera and species, I have to thank those who have assisted me in various ways. First, to Mr. W. T. Blanford I owe the most sincere thanks, not only for the generous present of specimens mentioned above, but also for constant aid given throughout the preparation of the paper, an aid which has been of the greatest use to me from his extensive knowledge of India and its mammal fauna. I also owe my thanks to Dr. Anderson, for examining for me several of Blyth's types, preserved in the Calcutta Museum; and to Dr. J. Scully for the use of his specimens from Gilgit, a locality particularly interesting as being just on the line between the Palearctic and Oriental zoological regions.

In this connection I must also record the very deep obligations I am under to my late friend Mr. E. R. Alston, whose premature death has deprived science of one whose careful and conscientious work upon Mammals is well-known to all zoologists, and who, since I first took up their study, has been a constant friend and helper to me in my work on that branch of science of which he had so intimate a knowledge.

The following are the subgenera into which the Indian species of *Mus* have been divided:—

1. *Nesokia*. Incisors very broad, finely sculptured in front. Molars composed of transverse laminæ. Size large; form stout and heavy; tail rather short; fur coarse, not spiny.

2. *Mus*. Incisors narrow, smooth in front. Molars tubercular. Pollex only with a nail, the other digits with sharp compressed claws. Other characters variable.

3. *Leggada*. Like *Mus*, but the first upper molar with an extra tubercle in front (see Plate LI. figs. 10, 11). Fur generally, but not always, spiny; size small; tail short.

4. *Vandeleuria*. Teeth as in *Mus*. Both 1st and 5th digits of fore and hind feet with a nail. Size small; form slender and agile; fur soft; tail very long.

Subgenus NESOKIA.

Neotoma, Ell. Madr. Journ. x. p. 208 (nec Say and Ord), 1839.

Nesokia, Gray, Ann. & Mag. Nat. Hist. x. p. 264, 1842.

The members of this subgenus may always be readily distinguished by their bluff-headed and arvicoline aspect. Their dentition is

markedly different from that of *Mus* proper; and until recently *Nesokia* has been looked upon as a full genus; but Dr. Anderson, in the paper referred to above, states that he considers it to be only a subgenus of *Mus*, an opinion in which for the present I am disposed to concur. Dr. Anderson's paper contains a full and careful account of the group; but as he had not the advantage of examining Hodgson's and Gray's types, some of the synonyms were incorrectly placed, the natural result of such descriptions as had been given of these Rats.

I have been compelled to reduce the number of species somewhat, Dr. Anderson having allowed seven Indian species, while I consider that there are only four, with two subspecies or varieties. The reasons in each case will be given below.

The known range of the subgenus is, east and west, from Palestine to Formosa, the British Museum possessing specimens from both these localities, and, north and south, from Kashghar to Ceylon. The Palestine *Nesokia*, which was collected by Canon Tristram, appears to represent a new species; but, without seeing more specimens, I do not care to describe it as such.

The following synopsis, based on Dr. Anderson's "Sections," will show some of the chief distinguishing characters of the Indian species:—

- I. Anterior palatine foramina much shorter than the upper molar series; mammæ 8..... *M. (N.) hardwickei*, p. 524.
- II. Anterior palatine foramina as long as or longer than the molar series; mammæ 14–18 *M. (N.) bengalensis*, p. 526.
- III. Palatine foramina as in II., though rather more open behind. Mammæ 12.
 - a. Nasals broad, size very large *M. (N.) bandicota*, p. 528.
 - b. Nasals narrow, size smaller *M. (N.) nemorivagus*, p. 529.

1. MUS (NESOKIA) HARDWICKII.

a. Var. *hardwickei*.

Arvicola indica, Gray & Hardw. Ill. Ind. Zool. i. pl. xi. (1832)
(nec *Mus indicus*, Bechst.).

*¹ *Mus hardwickei*, Gray, Charlesw. Mag. N. H. i. p. 585 (1837).

Nesokia hardwickei, Gray, Ann. & Mag. N. H. x. p. 265 (1842).

*? *N. griffithii*, Horsf. Cat. Mamm. Mus. E. I. C. p. 145 (1851).

Spalacomys indica, Peters, Abhandl. Akad. Berl. 1860, p. 143, Taf. ii. f. 1 (skull) (1860).

M. (N.) hardwickei, Anders. J. A. S. B. xlvii. p. 221 (1878).

Hab. From Sind and the Punjab eastwards to the North-west Provinces.

b. Var. *huttoni*.

* *Mus huttoni*, Blyth, J. A. S. B. xv. p. 139 (1846).

Nesokia huttoni, Blanf. Zool. Pers. p. 59, pl. vi. fig. 1 (1876).

M. (N.) huttoni, Anders. *t. c.* p. 223 (1878).

Hab. Persia, Afghanistan, and the more elevated parts of Sind.

Specific characters.—Fur variable in quality. Length from six to

¹ The asterisks prefixed to the names in the synonymy throughout, designate those species of which the types are in the British Museum.

seven inches; tail about equal to the body without the head. Mammæ 8, 2 pectoral and 2 inguinal pairs¹. Skull very stout and strong, readily distinguished by its very short and narrow anterior palatine foramina, which are not so long as the first two upper molars, while those of the next species, *N. bengalensis*, are as long as the whole upper molar series. Teeth more rounded than in the other *Nesokia*, the laminae more compressed from before backwards. (See Dr. Peters's figure referred to above.)

Varietal Characters.—Var. *hardwickei*. Fur generally short and harsh, yellowish brown above, dirty white below. Feet shorter than in var. *huttoni*.

Var. *huttoni*. Fur long and soft, bright rufous above, dull yellow below. Hind feet longer than in var. *hardwickei*.

Measurements.

	Var. <i>hardwickei</i> .		Var. <i>huttoni</i> .
	♂. Tong, Sind.	♂. Jaco- bad, Sind.	♂. Balu- chistan.
Head and body ²	5·9	6·3	6·5
Tail ³	3·8	4·35	4·5
Hind foot ⁴	1·2	1·2	1·45
Forearm and hand ⁵	1·7	1·61	1·95
Ear-conch, length ⁶	·52	·59	·57
Muzzle to ear ⁷	1·45	1·45	1·55

These measurements would appear to be rather below the average, those given by Dr. Anderson being considerably more.

I think there can be but little doubt as to the necessity of uniting the two forms of this species. One of our specimens (*a*), from Tong, Sind, has the long, soft and bright-coloured fur of var. *huttoni*, while

¹ Mr. Blanford (*l. c.*) stated that there were only 6 mammæ in his Persian specimens; but he must have overlooked one of the anterior pairs, as those of his specimens which came to the British Museum have 8, as also, *vide* Dr. Anderson, have those that went to Calcutta.

² Taken by placing the head and body as nearly as possible flat, and then measuring in a straight line, and not along the curves.

³ From the anus to the end of the vertebrae, one point of the compasses being placed quite in the anus, so as to get to the true root of the tail.

⁴ From the calcaneum to the tip of the longest toe, not including the claws.

⁵ From the olecranon to the tip of the longest finger, also without the claws. This is a most useful measurement for showing the comparative lengths of the fore and hind limbs, that of the hand only being extremely difficult to take with accuracy.

⁶ From the external root of the conch (see Plate LI, fig. 7, *a* to *b*). The skin shifts so much on the head that measuring from the meatus is very unsatisfactory.

⁷ From the tip of the nose to the inside of the auditory meatus, one point being placed in the meatus as far as it will go without hurting the skull. This is a measurement which should always be given, being almost the only one that can be relied upon for perfect accuracy in showing the general size of the animal. It is particularly useful with regard to the proportion that the limbs and tail bear to the trunk.

I may here state that every measurement given is taken from a specimen preserved in spirit, except where otherwise stated, and that therefore the size of the body will be found to be somewhat larger when measured in the flesh.

the shortness of its feet would cause it to be placed with var. *hardwickei*. Of several skins from the same place, moreover, some have all the fur-characters of one and some of the other variety. Mr. Blanford, in his 'Mammalia of Yarkand'¹, has said that he doubts whether the differences between the two forms are constant; and Dr. Anderson seems to have been quite unable to find any important differences between the skulls, though he keeps the two species distinct². I think therefore that it will be better to regard *N. hardwickei* and *N. huttoni* as geographical races of one species, the former occupying the low countries of Sind and North-west India, and the latter the comparatively higher regions of Persia and Afghanistan. It is true that the types of the two varieties look extremely different; but that of *M. (N.) hardwickei* has been enormously overstretched, so that it looks quite double the size of that of *M. (N.) huttoni*, its skull and feet, however, showing that the difference in size is almost wholly artificial.

The type of *N. griffithii*, Horsf., is undoubtedly a specimen of this species, and seems to be, on the whole, rather more like var. *hardwickei*; but it is such a bad skin that I cannot determine this point with certainty. *Mus pyctoris*, Hodgs., which Dr. Anderson placed here, is not a *Nesokia* at all, but a true *Mus*, as shown by the type, and is a synonym of *M. alexandrinus*, var. *nitidus*³.

2. MUS (NESOKIA) BENGALENSIS.

a. Northern race (*N. bengalensis*).

Arvicola bengalensis, Gray & Hardw. Ill. Ind. Zool. ii. pl. 21 (1833-34).

* *Mus daccanensis*, Tytler, Ann. & Mag. N. H. xiv. p. 173 (1854).

M. * *tarayensis* et * *plurimammis*, Hodgs., Horsf. Ann. & Mag. N. H. xvi. p. 112 (1855).

* *M. morungensis*, Hodgs., Horsf. l. c. (juv.) (1855).

Nesokia indica, Blyth, J. A. S. B. xxxii. p. 328 (1863); Jerd. Mamm. Ind. p. 187 (1867) (nec *M. indicus*, Bechst.).

M. (N.) blythianus, Anders. J. A. S. B. xlvii. p. 227, pl. xiii. figs. a to d (1878).

M. (N.) barclayanus, Anders. t. c. p. 229, pl. xiii. figs. i to l (1878); Blanford, Zool. Yark. Exp., Mamm. p. 46, pl. x. a. fig. 1 (skull) (1879).

Hab. North and Central India. ? Malacca and Andaman Islands.

b. Southern race (*N. kok*).

* *Mus kok*, Gray, Charlesw. Mag. N. H. i. p. 585 (1837).

* *M. (Neotoma) providens*, Ell. Madr. Journ. x. p. 209 (1839).

* *M. dubius*, Kel. J. A. S. Ceylon, 1851 (nec Hodgs.) (1851).

¹ Mamm. Yark. Exp. p. 47, 1879.

² Dr. Anderson now agrees with me as to the propriety of uniting these two forms.

³ See below, p. 533.

Nesokia hardwickei, Kelaart, Prodr. Faun. Zeyl. p. 65 (1852) (nec Gray).

M. (N.) providens, Anders. J. A. S. B. xlvii. p. 225, pl. xiii figs. *e* to *h* (1878).

Hab. South India and Ceylon.

Specific Characters.—Form stout and heavy, muzzle blunt. Fur rather short and harsh, grizzled brown above, rather paler below. Ears short; laid forward they do not reach to the eyes. Tail shorter than the head and body, uniformly brown above and below. Feet of medium size, nearly always brown above. Foot-pads small and rounded, five on the fore and six on the hind feet, as in the other species of the subgenus. Mammæ very numerous, from 14 to 18 in number, often different on the two sides of the body.

The skull is rather more like that of a true *Mus* than in *N. hardwickei*. The most important differences between the two have been mentioned under that species.

Varietal Characters.—Var. *bengalensis*. Size comparatively large. Tail somewhat longer in proportion, and anterior palatine foramina often (but by no means always) larger than in the southern race. Skull otherwise quite similar.

Var. *kok*. Smaller. Tail somewhat shorter than in the typical variety. Anterior palatine foramina very narrow.

Measurements.

	Var. <i>bengalensis</i> .		Var. <i>kok</i> .	
	Calcutta ¹ .		Ootacamund.	Madras.
	♂	♀	♂	♀
Head and body	8·0	7·8	7·3	7·0
Tail	7·4	7·0	5·7	6·3
Hind foot.	1·4	1·45	1·32	1·4
Forearm	2·0	2·05	1·75	1·81
Ear-couch, length	·82	·80	·80	·75
Muzzle to ear	1·6	1·7	1·6	1·6

This species is the common *Nesokia* of the whole of India. The only animal with which it could possibly be confounded is *Mus decumanus*, from which, however, it may always be distinguished by its comparatively shorter head and broader incisors.

Dr. Anderson, in his paper above quoted, keeps the northern and southern forms separate under the names of *N. blythianus* and *providens*. The following are the characters upon which he founds his opinion as to their specific distinction:—"The skull (of *N. providens*) is considerably smaller than that of *M. (N.) blythianus* of the same age, from which it is also distinguished by its more outwardly arched malar process of the maxillary, by its considerably smaller teeth, and long but less open palatine foramina." The external characters given are those I have used to divide the species into varieties, except the "somewhat smaller ears" of *N. kok*, a character which does not

¹ These seem to be exceptionally large specimens, none of the specimens measured by Dr. Anderson having hind feet as much as 1·4 inch.

appear to be constant, as a specimen from the Neilgherries has distinctly larger ears for its size than any specimen of *N. bengalensis* that I have seen. As to the skull-characters mentioned, I can only suppose Dr. Anderson had but a small series under examination at the time of writing his paper; for, as far as I can see, the skulls intergrade completely. Taking the characters as given above, we see that the southern race is certainly a little smaller, but not very much; in fact two Madras specimens of ours are quite as large as average Bengal ones. I cannot see that there is any difference in the outward spread of the zygomatic arches, or in the size of the teeth. As to the anterior palatine foramina, it is true that many specimens of var. *bengalensis* have these very much broader; but, on the other hand, some of our Nepal specimens, necessarily of the northern form, have them fully as much contracted as any Madras individuals; we cannot, therefore, place any reliance on this character. The other characters incidentally mentioned seem all to be either variable or not sufficient to separate the two forms upon.

With regard to the name adopted for the species, I cannot agree with Dr. Anderson that Gray's name *bengalensis* cannot stand. The figure of "*Arvicola bengalensis*" represents the northern form without a doubt; and even if this name were discarded, it will be seen by the synonymy that there are no less than four other names which would have priority over that give by Dr. Anderson. The types of all of them are in the British Museum, and certainly belong to this species.

M. (N.) barclayanus, Anders., as Mr. Blanford (*l. c.*) has suggested, seems to be only a local variety of *N. bengalensis*, and not distinct enough to require a name.

Mus setifer, Horsf. apud Cantor¹ (and therefore, fide Blyth, *M. andamanensis*, Bl.²), is, judging from one of Cantor's own specimens, certainly a *Nesokia*, and apparently not separable from this species. I do not care, however, definitely to unite them until I have seen spirit specimens from Pinang or the Andamans, as some of the proportions may be different from those of the Bengal species, Cantor's specimen being a much stretched skin.

3. MUS (NESOKIA) BANDICOTA.

Le Rat perchal, Buff. Hist. Nat. Supp. vii. p. 276, pl. 69 (1789).

Rat perchal and *Bandicota*, Penn. Hist. Quadr. (ed. 3), ii. pp. 179, 180 (1793).

"*Der Bandikote*," et "*die indische Ratte*" Bechstein, Allgem. Uebers. der vierfüssige Thiere³, ii. pp. 497, 498 (ex Penn.) (1800).

Mus bandicota et *M. indicus* (nec Geoff.), Bechstein, tom. cit. pp. 713, 714 (1800).

M. malabaricus et *M. perchal*, Shaw, Gen. Zool. ii. pt. 1, pp. 54, 55 (1801).

M. giganteus, Hardw. Trans. Linn. Soc. vii. p. 306, pl. 18 (1804).

¹ J. A. S. B. xv. p. 254, 1846.

² J. A. S. B. xxix. p. 103, 1860.

³ A German translation of Pennant's 'History of Quadrupeds', published at Weimar in two volumes, 4to, 1799-1800.

M. (Neotoma) giganteus, Ell. Madr. Journ. x. p. 209 (1839).

M. (Nesokia) giganteus, Anders. J. A. S. B. xlvii. p. 232, pl. xiv. figs. *a* to *d* (skull) (1878).

Hab. All India south of the Himalayan region, and Ceylon.

Size very large, over a foot in length. Tail generally about one fourth shorter than the head and body. Fur very coarse and harsh; grizzled black and white above, grey beneath. On the back the fur is very thickly mixed with long harsh black piles, much more numerous than in *M. (N.) nemorivagus*. Mammæ 12, three pectoral and three inguinal pairs. The skull is very large and heavy, being more than $2\frac{1}{2}$ inches long in full-grown individuals; it has been well figured by Dr. Anderson (*l. c.*), together with the skulls of the other species of *Nesokia*.

The Common Bandicoot or Pig-rat is found all over the peninsula of India, and is almost too well known to need any description. It may always be known from large individuals of *Mus decumanus* by its much broader incisors and by the presence of the long black piles mixed with the fur of the back; these piles are often nearly 4 inches long, while they are quite absent in *M. decumanus*. *Mus (N.) nemorivagus*, its nearest ally, is the Bandicoot of North-eastern India, and is certainly very closely related to it; but I think that the two forms are specifically separable, the Hinnalayan form being smaller and having much softer fur, fewer long black piles, and narrower nasal bones. The differences in the skulls will be readily perceived by a reference to Dr. Anderson's plate above referred to.

4. MUS (NESOKIA) NEMORIVAGUS.

* *Mus nemorivagus*, Hodgs. J. A. S. B. v. p. 234 (1836); Ann. & Mag. N. H. xv. p. 266 (1845).

?* *M. macropus*, Hodgs. Ann. & Mag. N. H. xv. p. 268 (juv) (1845).

?* *Nesokia hydrophila*, Gray, Cat. Hodgs. Coll. p. 19 (1846) (nec Hodgs.).

* *M. bandicota*, Swinh. P. Z. S. 1870, p. 635 (nec Bechst.).

M. (Nesokia) elliotanus, Anders. J. A. S. B. xlvii. p. 231, pl. xiv. figs. *e-h* (skull) (1878).

Hab. Nepal, Sikhim, Assam; Formosa (*Swinhoe*).

Smaller than the Common Bandicoot, from 9 to 11 inches in length, the tail about seven eighths of the length of the head and body. Fur comparatively soft, a certain number of longer piles intermixed; but these are neither so numerous nor so stiff as in *M. (N.) bandicota*. For further information about this species I must refer the reader to Dr. Anderson's description and figure of his *M. (N.) elliotanus*.

The following dimensions, as being those of a spirit specimen, may be of use. It is an adult female, and was obtained from the Khasi Hills by Mr. Blanford:—

Head and body 9 inches; tail 7·8; hind foot 1·9; forearm 2·35; ear-conch, length 0·9.

To Dr. Anderson belongs the credit of having perceived that there are two species of Bandicoot in India, all previous authors having confused this form with the true *M. bandicota*, Bechst. Hodgson's description of *M. nemorivagus*, however, was such that Dr. Anderson naturally could not tell that his *M. (N.) elliotanus* was identical with it. There can, however, be no doubt that it is the same, as the skull of the type of Hodgson's species exactly matches that of one of the Khasi-Hill specimens mentioned by Dr. Anderson, and since presented to us by Mr. Blanford, and also quite agrees with the figure which accompanies the description of *M. (N.) elliotanus*¹.

Formosan individuals of this species received from Mr. Swinhoe are quite similar to our specimens from the typical locality. We thus get another instance of the affinity of the fauna of Formosa to that of the Himalayan region².

The specimen described as *Nesokia hydrophila* by Dr. Gray, in his Catalogue of Hodgson's collection, is the actual type of *Mus macropus*, Hodgs. The cause of the mistake was that Hodgson's two species *M. hydrophilus* and *M. macropus* are figured side by side in Hodgson's drawings, and that in the British Museum duplicate copy the plate was accidentally marked as "*Mus hydrophilus et junior*," Gray therefore describing the specimen representing the adult form. In the original drawings, belonging to the Zoological Society, however, the two figures are named in accordance with Hodgson's published descriptions. This type specimen of *M. macropus* is most undoubtedly a *Nesokia*, and, I believe, will turn out to be a young specimen of the present species, the skull agreeing very fairly, though it is considerably smaller.

I am quite unable to say what the true *M. hydrophilus*, Hodgs.³, is. It is said to be a small species, only $3\frac{1}{2}$ inches long, with a tail only $2\frac{3}{4}$ in length. We have received no specimens of it from Mr. Hodgson; but I would suggest that it might be some species of *Arvicola*, as the proportions are similar to those found in that genus, and Hodgson on his drawing calls it *Arvicola? hydrophilus*, though he afterwards described it as a *Mus*.

It seems possible, as Mr. Blanford has suggested⁴, that *M. (Nesokia) nemorivagus* will yet turn out to be identical with the true *Mus setifer*, Horsf. Judging from the distribution of certain other species, it is quite probable that the Bandicoot of Java should be the same as that found in Nepal and Formosa; but merely from Horsfield's description, and without seeing Javan specimens, it is impossible to decide this question at present.

Subgenus *Mus* (restricted).

Mus, Linn. Syst. Nat. (12) i. p. 79 (1766).

Incisors narrow, smooth in front. Molars tubercular, not divided

¹ Dr. Anderson has sent us an immature specimen of his *N. elliotanus*, which quite confirms my identification.

² See below, under *M. jerdoni*, p. 539.

³ Ann. & Mag. N. H. xv. p. 267, 1845.

⁴ Zool. Yark. Exp. Mamm. p. 47, 1879.

into transverse laminæ as in *Nesokia*. Pollex truncated, with a short nail, all the other digits with sharp compressed claws.

To *Mus* as thus strictly limited I refer 12 of the species of Muridæ that have as yet been found within our limits; but there can be no doubt that several more species either hitherto undescribed, or only known from Assam and Burmah, will yet be found in Sikhim and the surrounding region. On the other hand, it seems improbable that there are many more species to be recorded from the peninsula of India, though the discovery of such a distinct form as *Mus blanfordi* shows that this region is not as yet absolutely worked out.

The following synopsis will, I hope, be of use to persons wishing to determine specimens of this difficult group; but it will as a rule be necessary for those who consult it to examine properly preserved spirit or fresh specimens, as the characters used are not such as can be easily made out on dried skins. Wherever stress is laid on the proportion of any part to the head and body, it must be remembered that fresh specimens always have the trunk distinctly larger in proportion to the extremities than those preserved in spirit, and that all my measurements are of necessity from the latter. It will therefore sometimes happen that in a fresh specimen the tail is slightly shorter than the head and body when I have here stated it to be longer; but a reference to the detailed descriptions will always obviate any difficulty this may cause.

I. Hind feet with 6 well-defined foot-pads.

A. Large, $4\frac{1}{2}$ to 9 inches; last hind foot-pad elongated.—RATS.

a. Whole of tail covered with short hairs; upperside of tail dark-coloured. 8–12 mammæ.

a. Tail dark above and below.

a'. Tail shorter than head and body; 10–12 mammæ; hind foot 1·5–1·7.

b'. Tail longer than head and body.

a". Anterior edge of zygoma-root with a strongly marked rounded angle above. 10–12 mammæ; hind foot 1·2–1·45.....

b". Anterior edge of zygoma-root nearly perpendicular; hind foot ·95–1·05.....

β. Tail sharply bicolor, dark above and white below. 8 mammæ.

c'. Back bright rufous; tail much longer than head and body; hind foot 1·0–1·15.....

d'. Back yellowish grey; tail barely longer than head and body; hind foot 1·0.....

b. Distal third of tail with longer hairs, white above and below. 6 mammæ.

e'. Hind foot 1·2–1·35.....

1. *M. decumanus*, p. 532.

2. *M. alexandrinus*, p. 533.

3. *M. fulvescens*, p. 537.

4. *M. jerdoni*, p. 537.

5. *M. niveiventer*, 540.

6. *M. blanfordi*, p. 541.

- B. Small, 2-4 inches. Last hind foot-pad circular.—MICE.
- c. Anterior edge of zygoma-root perpendicular.
- γ. 10 mammæ.
- f'. Tail as long as, or longer than, head and body.
- c". Colour rufous-brown, belly scarcely lighter; hind foot '62-7. 7. *M. urbanus*, p. 544.
- d". Colour pale fulvous, belly white; hind foot '65-75. 8. *M. bactrianus*, p. 546.
- g'. Tail shorter than head and body. (See also under *Leggada buduga*, p. 553.)
- e". Hind foot '6-65; ear '41-49 ... 9. *M. cervicolor*, p. 547.
- δ. 6 mammæ.
- h'. Tail as long as, or longer than, head and body; hind foot '82-88. 10. *M. arianus*, p. 548.
- d. Anterior edge of zygoma-root slanting. (See Plate LI. fig. 8.)
- i'. Tail rather longer than the head and body; hind foot '75-8. 11. *M. nitidulus*, p. 550.
- II. Hind feet with only 4 or 5 properly developed foot-pads.
- e. 8 mammæ; tail about the length of head and body; hind foot about 1'0. 12. *M. mettada*, p. 550.

5. MUS DECUMANUS.

M. decumanus, Pall. Nov. Glir. p. 91 (1778).

*M. decumanoïdes*¹, Hodgs. J. A. S. B. x. p. 915 (sine descr.) (in part) (1841).

**M. brunneus*, Hodgs. Ann. & Mag. N. H. xv. p. 266 (1845).

Hab. Cosmopolitan.

No description is needed of this too well-known rat. It may always be distinguished from any specimen of *M. alexandrinus* by its short tail and ears, and its larger size. The following are the chief dimensions of a full-grown male:—Head and body 8'3, tail 7'1, hind foot 1'6, ear-conch 0'7, muzzle to ear 1'85.

The type of *Mus brunneus*, Hodgs., is certainly a specimen of this species, as might be expected from his description. Though most certainly not indigenous, Mr. Blanford tells me that these Rats are found on all the rivers of India, being carried up by the boats, and that by this means they might easily have got into the valley of Nepal, by way of the rivers Gunduck and Coosy.

We now come to the truly indigenous Indian species of *Mus*. The first one that claims our attention is the common house- and tree-rat of the whole of India, the *Mus rufescens*, Gr., of Blyth and other authors. After careful comparison of a very large number of specimens from all parts of India, I have come to the conclusion that

¹ In Horsfield's 'Catalogue of the Mammals in the India Museum' (p. 140), he mentions a "*Mus decumanoïdes*, Temm." Temminck never described a Rat under this name, as far as I can find; and Dr. Jentink, of the Leyden Museum, where Temminck's types are preserved, has kindly confirmed my opinion on this point.

this Rat is only a southern offshoot of that form of *Mus rattus* commonly known as *M. alexandrinus*. In India we find three just distinguishable varieties of it:—(1) the true *M. alexandrinus*, found in Cashmere, and the whole north-west region of India; (2) the form confined to the Nepalese district, here termed var. *nitidus*, Hodgs.; and (3) the well-known *M. rufescens*, Gr., found in the whole of continental India except the north-western part, and also in Burmah.

The following is the Indian synonymy of this species and its two varieties; but it is very possible that some of the names are put under the wrong varieties, as these are not very sharply separated from each other.

6. MUS ALEXANDRINUS.

a. Typical variety.

M. alexandrinus, Geoff. Desc. de l'Égypte, Hist. Nat. ii. p. 733, Atl. pl. v. fig. 1 (1812).

**M. asiaticus*, Gray, Charlesw. Mag. N. H. (2) i. p. 585 (1837).

“*M. arboreus*, Buch. Ham.”¹ Horsf. Cat. Mus. E.I. C. p. 141 (in part) (1851).

?*M. crassipes*, Blyth, J. A. S. B. xxviii. p. 295 (juv.) (1859).

b. Var. *nitidus*.

**M. nitidus*, Hodgs. Ann. & Mag. N. H. xv. p. 267 (1845).

**M. pyctoris*, Hodgs. *l. c.* (1845).

?*M. rattoides*, Hodgs.² *l. c.* (1845).

M. horeites, Hodgs. *l. c.* p. 268 (juv.) (1845).

**M. æquicaudalis*, Hodgs. op. cit. (2) iii. p. 203 (1849); Horsf. Cat. Mamm. Mus. E.I. C. p. 144 (1851).

c. Var. *rufescens*.

M. indicus, Geoff., Desm. Mamm. ii. p. 299 (nec Bechstein³, 1800) (1822).

**M. rufescens*, Gray, Charlesw. Mag. N. H. (2) i. p. 585 (1837).

**M. flavescens*, Ell. Madr. Journ. Lit. Sci. x. p. 214 (1839) (nec Waterh. P. Z. S. 1837, p. 19).

M. decumanoides, Hodgs.⁴ J. A. S. B. x. p. 915 (sine descr.) (in part) (1841).

**M. brunneusculus*, Hodgs. Ann. & Mag. N. H. xv. p. 267 (1845).

¹ The drawing and description, but not the specimen (B), which is *M. decumanus*.

² Or the true *Mus rattus*; more probably a black-bellied individual of this variety.

³ See under *M. (Nesokia) bandicota*, p. 528.

⁴ Never described; afterwards divided by Hodgson into *M. brunneus* and *brunneusculus*.

M. nemoralis, Blyth¹, J. A. S. B. xx. p. 168 (1851).

**M. kandianus* & **M. tetragonurus*, Kel. J. As. Soc. Ceylon (1851).

M. ceylonus, Kel. Prodr. Faun. Zeyl. p. 61 (juv.) (1852).

M. robustulus, Blyth, J. A. S. B. xxviii. p. 294 (1859), fide Blandford, J. A. S. B. xlvii. p. 165 (1878).

?*M. infralineatus*, Blyth, J. A. S. B. xxxii. p. 348 (1863) (juv.).

"*Euchætomys*² *rufescens*, Gray," Fitzinger, SB. Ak. Wien. lvi. i. p. 74 (1867).

Specific Characters.—Fur harsh, sometimes mixed with fine spines. Colour varying from dark rufous-grey to bright reddish fulvous; belly sometimes quite white, sometimes no lighter than the back. Feet nearly always white. Tail longer than the head and body, *scarcely lighter below than above*. Ears large; laid forward they reach quite to, or even beyond the eye. Foot-pads 5–6, well-defined. Mammæ 10, 11, or 12, normally three pectoral and three inguinal pairs; but one or both of the posterior pectoral pair are often absent. The length of the head and body (in spirit) varies from 5 to 7, the tail from 6 to 9, and hind foot from 1.2 to 1.5 inches; these, however, are the extreme limit. For detailed measurements see below.

Varietal Characters.—*Typical variety*. Dark rufous-grey above, white below. Size large, over 6 inches; tail much longer than the head and body, more noticeably paler below than in the other varieties. Soles of feet nearly always white (in spirit).

Variety *nitidus*. Fur finer and rather more rufous, often mixed with numerous spines. Belly sometimes pure sharply-defined white, sometimes almost as dark as the upperside, the tips of the hairs, however, being nearly always white. Size about the same as in typical *alexandrinus*. Tail generally only a little longer than the head and body, seldom exceeding them by more than one inch; stretched skins therefore often have the tail even shorter than the trunk. Soles of feet often quite black.

Variety *rufescens*. Body small and slender, only just over 5 inches in length. Tail much longer than the head and body. Colour dull rufous, generally but little paler below; fur coarse and spinous. This variety is much more arboreal than the others.

I can find no differences whatever between the skulls of these three varieties. Their general characters are too well-known to need any detailed description; the dimensions of a specimen of var. *rufescens* will be found below under *Mus blanfordi*³. The remarkable variation in the length of the nasal bones presented by this species is referred to below⁴.

¹ Blyth, op. cit. xxxiv. p. 192 (1865), says that this is the same as *M. brunneus*, Hodgs., which is a *Mus decumanus*; his description, however, agrees much better with this form, and a specimen sent as *M. nemoralis* by Dr. Anderson is certainly a *Mus rufescens*.

² A genus (!), composed of a ridiculous mixture of species of *Mus*, *Nesokia*, and *Leggada* which have no special affinity with each other whatever.

³ Vide p. 541.

⁴ Vide p. 536.

Table of Measurements.

	Var. <i>alexandrinus</i> .			Var. <i>nitidus</i> .			Var. <i>rufescens</i> .	
	Cashmere.		Muscat.	Darjiling.			Madras.	Ceylon.
	♂	♀	♀	♂	♂	♀	♀	♀
Head and body.....	6.1	6.3	6.1	6.8	6.45	5.8	5.5	5.2
Tail	7.1	7.3	9.3	7.3	6.7	6.2	6.7	7.65
Hind foot	1.4	1.25	1.29	1.45	1.4	1.2	1.45	1.22
Forearm and hand	1.66	1.50	1.64	1.8	1.7	1.5	1.67	1.45
Ear-conch, length...	.68	.71	.85	.76	.78	.71	.71	.70
Muzzle to ear	1.44	1.49	1.55	1.72	1.56	1.38	1.4	1.31

These varieties seem to grade insensibly into one another. The Rats of Cashmere and the neighbouring region agree perfectly with Egyptian specimens of *M. alexandrinus*¹; then, proceeding southwards, we find their fur becoming rather coarser and more rufous, and the animals themselves becoming smaller, though presenting still much the same proportions. On the other hand, as we go from Cashmere to Nepal, we find every intermediate stage between the true *M. alexandrinus* and the fine-haired, comparatively short-tailed var. *nitidus*². We must therefore consider them all to be of but one species, especially as we often find specimens which, without a knowledge of locality, it would be quite impossible to assign with certainty to any one of these three different forms.

With regard to the name adopted for the South-Indian variety, Mr. Blanford has kindly examined for me the types of *Mus indicus*, Geoffr., in the Paris Museum, and tells me that they are most certainly specimens of the Rat generally known as *M. rufescens*, Gr.; and as their locality (Pondicherry) is a place where *M. rufescens* would naturally be found, I think there can be no doubt whatever as to the correctness of Mr. Blanford's opinion. As, however, the name *M. indicus* has been previously used by Bechstein, the later name *M. rufescens* must still stand for the Common Rat of the peninsula of India. The types of both *M. indicus* and *M. rufescens* have been much stretched, so as to have given rise to the erroneous statement in each case "Tail shorter than the head and body."

I have not space to discuss the various synonyms given above; but it will be seen that we have the types of a great number of these so-called species; and those of Hodgson's names to which I have not prefixed an asterisk merely represent forms of which we really possess the typical specimens among our series, but, as they are not specially marked as such, I am unable to lay my hand upon them.

¹ In Dr. Scully's most useful paper "On the Mammals of Gilgit" (P. Z. S. 1881, p. 204), we find the following:—"The Gilgit Rat is not separable from the so-called *M. rufescens* of Calcutta, or *M. robustus*, Blyth, of Burma; and it also agrees in all essential characters with *M. alexandrinus*, Geoff. A specimen of *M. alexandrinus* from Algeria, in the British Museum, only differs from one of my Gilgit specimens in having rather harsher fur."

² The typical *M. rufescens* is also found in Nepal, there being a considerable series of this form from that country sent by Dr. Anderson.

I have, with some doubt, placed *M. infralineatus* under var. *rufescens*, as the colour characters given are quite unimportant, and the proportions might be those of an overstretched half-grown individual; it is, however, very possible that I may be wrong, and that it is a distinct species.

Sir Walter Elliot informs me that this species seems to be gradually giving way before the more powerful *M. decumanus*, which has been introduced into the various Indian ports from the shipping, just as in Europe the same ubiquitous species has nearly exterminated the corresponding northern form *Mus rattus*.

With regard to the specific distinctness of *Mus alexandrinus* from *M. rattus*, about which so much has been written, it seems to me that we have here a somewhat parallel case to that of *M. urbanus* and *M. musculus*. *M. alexandrinus* would seem to be a more tropical form of *M. rattus*; but as it seems always to have much shorter, coarser, and more rufous hair, as compared with the black and shining fur of *M. rattus*, I have provisionally kept them distinct, though I have but little doubt that they will have finally to be considered as but one species. This, however, is a question not specially Indian; and so at present I prefer to avoid expressing any definite opinion on the subject.

The extraordinary variation of the nasal bones of this species has been mentioned above. Some authors have used the length of these bones as a specific character; and certainly the extremes in this species are so great as to appear to be of importance; but when a series is examined it will be found that no stress can be laid on this character. In order to prove how great the variation is, I have prepared the following Table; all the specimens measured were collected *at the same time and place*, and are obviously all of the same species.

Measurements of Skulls and Nasal Bones of Darjiling Rats (*Mus alexandrinus*, var. *nitidus*):—

Total length of skull. millim.	Nasal bones. millim.	Percentage of nasal bones to rest of skull.
31·6	10·5	49
33·5	11·0	46
39·0	15·0	62
40·0	14·5	57
41·9	16·4	64
42·0	14·8	54
42·5	17·0	66
42·6	14·6	52
44·0	18·0	69
44·5	17·0	62
44·7	16·7	59
48·0	19·5	69

If we now arrange these percentages in order, we obtain the following series, in which it is perfectly impossible to draw any dividing line

between the specimens with long and those with short nasal bones—46, 49, 52, 54, 57, 59, 62, 64, 66, 69. After examining such a series of figures as this, I think it will be generally admitted that the length of the nasal bones is a character which should be regarded with the very greatest caution before it is used to separate species upon.

7. *MUS FULVESCENS*.

**Mus fulvescens*, Gray, Cat. Hodgs. Coll. p. 18 (1846).

**Mus candatior*, Hodgs. Ann. & Mag. Nat. Hist. iii. p. 203 (1849); Horsf. Cat. Mus. E.I. C. p. 144 (1851).

Mus cinnamomeus, Blyth, J. A. S. B. xxviii. p. 294 (1859), nec Pictet, Not. Anim. Nouv. Mus. Gen. p. 64, pl. 19 (1844).

Hab. Nepal and Sikhim; Pegu (*Berdmore*).

Fur soft and fine, generally spineless, but with sometimes a considerable number of spines intermixed. Colour bright rufous above, with slate-coloured bases to the hairs; belly white, generally quite pure, but sometimes either mixed with slate-colour or with a fulvous-grey stripe down its centre. Tail long, brown above, and but slightly paler beneath, sometimes with a tendency to the development of a pencil of hairs at the tip. I have not been able to find out the number of mammæ present in this species. The skull, as in *Mus jerdoni*, differs from that of *M. alexandrinus* by the absence of the projecting angle in the front of the exterior wall of the infra-orbital foramen, by the more open lower part of the same foramen, by its smaller teeth and shorter anterior palatine foramina. The difference in the zygo-ma-root will be better understood by a comparison of the figures of the two forms (Plate L. fig. 3 *a* & *b*).

With regard to the measurements, it unfortunately happens that we have no spirit-specimens of this species; but the following are the nearest that can be made out from skins:—Head and body 4·5 to 5·5 in., tail 5 to 7 in., hind foot ·95 to 1·05 in.

Mus octomammis, Hodgs., was placed as a synonym of *M. candatior* by Gray; but from Hodgson's drawing it would rather seem to be *M. jerdoni*, which we know has only eight mammæ.

The exact position of this species is very doubtful, and can only be settled by the examination of a good series of specimens properly preserved in spirit. Jerdon¹ placed *M. fulvescens* as a synonym of *M. infralineatus*, and quite separate from *M. candatior*; the types of this latter and of *M. fulvescens*, however, are undoubtedly identical.

8. *MUS JERDONI*.

Leggada jerdoni, Blyth, J. A. S. B. xxxii. p. 350 (1863).

? "*Mus octomammis*, Hodgs.," Gray, Cat. Hodgs. Coll. 2nd ed. p. 10 (1863) (sine descr.).

Hab. Sikhim; Khasya Hills, Assam (*Blanford*); Java (*v. Hügel*).

Fur long, fine, usually with numerous spines intermixed. Above

¹ Mamm. Ind. p. 197 (1867).

the general colour is bright rufous, the hairs being dark slate-colour for four fifths of their length, and the tips being orange-red; on the centre of the back there are numerous wholly black hairs mixed with the others; these thin out towards the sides, so that there the rufous colour is much clearer. Spines white, with black tips. Belly pure white, the line of separation well defined. Feet white as a rule, though sometimes the dark colour of the upper side runs down as far as the base of the digits. Tail very long, generally two and sometimes three inches longer than the head and body, brown above and white beneath from root to tip. Mammæ eight, two pectoral and two inguinal pairs. Hind foot-pads (Plate LI. fig. 1) six, large, nearly circular except the last, the terminal pad of the hallux very large. Ears rather large, oval; laid forward they reach quite to the eye.

The skull is somewhat like that of *M. fulvescens*, differing from that of *M. alexandrinus* by its smaller teeth, the upper series measuring in this species 5·8 millim., and in an equal-sized specimen of *M. alexandrinus*, 7·0 millim. The auditory bullæ are more flattened, only standing about 1·5 millim. above the base of the skull; while in *M. alexandrinus* they are 3 millim. high, and are much more inflated. There is the same form of the anterior zygoma-root already mentioned as obtaining in *M. fulvescens*; and, lastly, the emargination between the condyle and the posterior angle of the lower jaw seems to be shallower than usual.

Measurements.

	Darjiling.		
	<i>a.</i> ♂.	<i>b.</i> ♀.	<i>c.</i> ♂.
Head and body.....	5·3	(<i>c</i>) 5·0	5·4
Tail	7·1	6·8	8·5
Hind foot	1·15	1·15	1·15
Forearm.....	1·45	1·45	1·45
Ear-conch, length	·76	·68	·72
Muzzle to ear	1·38	..	1·30

It will be noticed that the hind foot and the forearm are exactly the same in all. Specimen *c* is said to have come from Malabar; but I think there can be no doubt that this is a mistake. This specimen has the longest tail in proportion to its size of any Indian species of the whole genus, its length being more than six and a half times the distance between the muzzle and the ear, while our longest-tailed specimen of *Vandeleuria oleracea* has it only six and a quarter times.

The palate-ridges (Plate LI. fig. 2) of this species show a slight difference from those of *M. alexandrinus*, there being an incomplete ridge between those answering to the fourth and fifth divided ridges of *M. alexandrinus*, thus making six instead of five divided ridges. This difference, though slight in itself, appears to be constant, as five spirit-specimens all show the extra ridge, while I have seen it

in none of the numerous specimens of *M. alexandrinus* I have examined.

This very handsome Rat may always be readily recognized by its brightly contrasted colours and its long bicolor tail. It is true that many specimens of *Mus fulvescens* have a somewhat similarly coloured body; but they always have the lower side of the tail of the same tint as the upper.

I have placed "*Mus octomammis*" here rather than under *M. fulvescens*, for the reasons already mentioned under that species.

The distribution of *M. jerdoni* presents some most interesting points. In Mr. A. R. Wallace's recent work, 'Island Life,' the author, when treating of the islands of Formosa¹ and of Java², states that the fauna of each of these two widely-separated places has a noticeable connexion with that of the Himalayan region. Now this species gives us a most interesting instance of the correctness of Mr. Wallace's views. Its headquarters seem to be in the Sikhim region; but a very young specimen collected by Baron A. von Hügel in Java is absolutely the same, it possesses even the minute fifth palate-ridge above mentioned; its fur is somewhat shorter, and, considering its age, more thickly spinous than is the case in Himalayan specimens; but these differences are only the natural result of a more tropical climate. With regard to Formosa, *Mus coringa*, Swinh.³, of which the types are in the British Museum, is so very closely allied to this species that I was at first disposed to consider it identical; but I now think it just separable on account of its longer hind foot (1.4 against 1.15). We thus have, isolated in these three places, nearly related Rats which seem to be quite unknown in the intermediate districts. *Mus (Nesokia) nemorivagus* presents us with another instance of this sort of distribution, being found in Nepal and Formosa; and if, as is just possible, the true *M. setifer*, Horsf., from Java, is the same, we have a still better example of the relations of these faunas to one another.

Mus jerdoni seems to be almost entirely a highland species. Those I have seen have come from Darjiling (7000 ft.), Khasya Hills (4000-5000 ft.), and Willis Mt., Java (3000 ft.). Jerdon⁴ mentions specimens from Kunawar (12,000 ft.); but, from the locality, I am inclined to think that they may have been *M. niveiventer*. Dr. Anderson tells me that these Kunawar specimens are not now in the Calcutta Museum; so that the question of the western distribution of this species cannot be settled at present.

When Blyth originally described *M. jerdoni* he stated that the head and body measured 4 inches and the tail $3\frac{1}{2}$ inches, proportions wholly at variance with those given above; but I am informed by Dr. Anderson that the type is only half-grown, and that specimens in the Calcutta Museum, undoubtedly identical, measure just about what those do of which the dimensions are given. Mr. Blyth described this Rat as a species of the subgenus *Leggada*, on account

¹ Chap. xviii. p. 375.

² Chap. xvii. p. 358.

³ P. Z. S. 1864, p. 185 (misprinted *coringa*, see P. Z. S. 1870, p. 636).

⁴ Mamm. Ind. p. 209 (1867).

of its spiny fur; it is, however, a true *Mus*, and has no connexion with the species of *Leggada*, the presence of spines being in no way an essential character of that subgenus.

With regard to these spines, our series of *M. coxinga* from Formosa shows every stage, from a specimen almost entirely spineless to one so thickly covered with spines that there are hardly any hairs. Mr. Swinhoe, in his original description, stated that the number of spines depended on age, the older specimens having the greater number; but I think season has quite as much to do with it, as we find specimens with the spines irregularly distributed in patches, as if these specimens were changing their fur with the season. This patchy arrangement, as far as one can see, could never obtain if the spines increased regularly in number according to the age of the individual. It seems probable, however, that both age and season have some connexion with the number of spines developed.

By the examination of such a series as that of *M. coxinga* and others, we are irresistibly led to the conclusion that the presence of spines in the fur, far from being a character of generic, or subgeneric, is not even of specific importance. Dr. Jentink, of the Leyden Museum, has recently¹, when describing various new species of *Mus*, divided the species primarily into those with spines and those without, laying great stress on this character. But I differ entirely from him as to its value; for not only have I seen, of the following Indian species, specimens both with and without spines—*M. alexandrinus* var. *nitidus*, *M. fulvescens*, *M. niveiventer*, *M. nitidulus*, and *M. (Leggada) buduga*,—but I have also observed the same thing in two Fijian specimens of *M. exulans*, Peale, and in the Central-American genus *Heteromys*, which normally has the fur altogether spinous.

On the whole, therefore, I am inclined to think that in all tropical countries, where the seasons of the year are tolerably well marked, a development of spines takes place in the summer, these falling off again in the winter. Spines are presumably a much cooler covering than hair, as all of the numerous spiny Rodents known are inhabitants of tropical or subtropical countries, and none of places with a distinctly cold climate.

It is worthy of notice that it seems to be the species with the finest and softest hair which have the greatest tendency to the development of spines. Thus the coarse-haired Rats, such as *Nesokia bengalensis*, *M. decumanus*, and *M. alexandrinus* var. *rufescens*, seldom appear to produce true spines; while, on the other hand, the fine-haired var. *nitidus*, *M. fulvescens*, and *M. coxinga* are at times the most spiny of all.

←9. *MUS NIVEIVENTER.*

**M. (Rattus) niviventer*, Hodgs. J. A. S. B. v. p. 234 (1836).

M. niviventer, Hodgs. Ann. & Mag. Nat. Hist. xv. p. 267 (1845); Gray, Cat. Hodgson's Coll. (1) p. 18 (1846).

Hab. The region bordering the Himalayas, from Simla to Katmandu; Darjiling (*Jerdon*)?

¹ Notes from the Leyden Museum, i. p. 7 (1878).

Fur rather coarse and short, sometimes thickly mixed with flattened spines, sometimes almost entirely without them. General colour above grey, with a tinge of yellow. Hairs dark slate-colour for nine tenths of their length; the tip in some yellow, in others black. The black-tipped hairs, which seem to be the coarser of the two, are more numerous in the centre of the back, so that that part is darker than the sides. Spines, when present, white, with black tips. Belly hairs and spines pure white to their roots, the line of demarcation sharply defined. Tail rather longer than the head and body, sharply bicolor, grey above and white beneath; hairs on its distal quarter slightly elongated.

With regard to the measurements I can only give approximate ones, as I have not seen any specimens of this species in spirit. The following given by Hodgson appear to be about the average:—Length, head and body 5·25, tail 6·0, hind foot 0·92. Blyth's two Másuri specimens were larger, viz. head and body 6·0 and 7·0, tail 7·0 and 7·5 in. respectively. These dimensions are sufficient to show that the tail is never so very much longer than the head and body as it is in *M. jerdoni*, from which this species may also be readily distinguished by its grey instead of rufous colour. The yellow mentioned in the description seems quite to correspond with the orange-red of *M. jerdoni*, occurring on the same parts of the hairs, and becoming clearer on the sides, in both species.

The skull, as was to be expected, is extremely like that of *M. jerdoni*, the only difference that I can perceive being that the nasal portion is somewhat more elongated in the present species.

This seems to be a rather scarce Rat, as Hodgson says of it, “of rare occurrence;” and the only specimens I have seen are five of his original series caught in the Residency house, Katmandu, and one collected at Simla by Mr. Blanford. Jerdon¹, however, says that he found it “very common at Darjiling;” but I am inclined to doubt his determination, as there are no specimens among the large series of Darjiling Rats collected by Mr. Blanford, while *M. jerdoni* is commonly found there, and might possibly have been mistaken for it.

10. MUS BLANFORDI. (Plate L.)

**Mus blanfordi*, Thomas, Ann. & Mag. Nat. Hist. (5) vii. p. 24 (1881).

Hab. Kadapa, Madras (*Beddome*).

Since my original description of this species was published we have been fortunate enough to receive a second specimen of it, also collected at Kadapa by Col. Beddome, and presented by him to the British Museum. This individual is a fully adult male, preserved in spirit, and is so very much larger than the type as to show that the latter, though its teeth were fully grown up, yet cannot have been quite full-grown. A few of the characters before given have therefore been found to be due to the immaturity of the specimen, and have had to be modified accordingly. The following description

¹ Mamm. Ind. p. 200.

is based on both specimens, and ought therefore to be fairly complete :—

Fur long and soft, above slate-coloured for seven eighths of its length, the terminal eighth being greyish fawn. The greater part of the belly is pure white in both specimens; but it is probably sometimes dark, as there is an indication of this colour on the centre of the chest in each case, as in certain specimens of *M. alexandrinus*. The tail is very much longer than the head and body; for half its length it is above and below dark-coloured and short-haired, as in other Rats; but then its colour abruptly changes to white all round, and the hairs gradually lengthen from this point and form a white brush at the tip. Dr. Scully's Gilgit specimens of *M. alexandrinus* have their tails much more hairy than is usual in that species; but in their other characters they in no way resemble *Mus blanfordi*.

The feet are entirely white in the adult male; but in the female there is a distinct brown tinge on the upper surface of both fore and hind feet; this, therefore, is no doubt variable.

The hind foot (Plate LI. fig. 6) is of somewhat different proportions from those which obtain in the other Indian Rats, the tarsus being somewhat long, while the phalanges are particularly short. The proportional lengths of the toes are much as in *Mus alexandrinus*, except in the case of the fifth digit on both fore and hind feet, which is rather longer as compared with the fourth. The pads are large and rounded, and, in the hind feet, somewhat crowded together, as shown in the figure.

The ears are large and dark-coloured. On their outer side the anterior half is thickly covered with short brown hairs, the posterior half being very nearly naked. On the inner side the hairs are much fewer and shorter than on the outer, and are mostly confined to the posterior half. In the original description the ears were said to be "nearly naked;" but this condition in the type was probably owing to the rubbing the ears had received in the taking-out of the skull.

As far as I can discover, there are only six mammæ in the female—one pair almost in the axillæ, and two pairs close together in the inguinal region.

The intestines have unfortunately been removed from both specimens, so that I have not been able to examine the cæcum.

Measurements.

	Ad. ♂.	♀ (type).
Head and body	6·0	4·1
Tail	8·0	6·1
Hind foot	1·33	1·2
Forearm and hand	1·6	1·3
Ear-conch, length . . . . .	..	·7
Muzzle to ear	1·5	.

It will thus be seen that, by its external characters only, *M. blanfordi* is a most distinct species, its whole appearance being quite different from that of any other Rat that I have seen. Its large

ears, long soft fur, white belly, and especially its long, white-tipped, hairy tail, cause it to be distinguishable at the first glance from all other Indian Muridæ; and I have had great pleasure in connecting with it the name of Mr. W. T. Blanford, to whose generosity in presenting to the British Museum his fine series of Indian Muridæ in spirit, and in lending me all his Indian skins, I owe the fact of my having been so far able to work out the Indian species of this most difficult genus of Mammals.

The skull of this species (Plate LI. figs. 4 & 5) is very distinct from that of *M. alexandrinus*. The following are the dimensions of the skull of the adult male of *M. blanfordi* and of that of a specimen of *M. alexandrinus* var. *rufescens*, which, being of precisely the same length, is particularly suitable for the purpose of comparison:—

	<i>Mus blanfordi</i> ♂. Kadapa.	<i>Mus rufescens</i> ¹ ♂. Calcutta.
Total length	1·65	1·65
Greatest breadth	·8	·8
Length of lower jaw ²	·96	·96
Nasal bones	·68	·58
Breadth between orbits	·28	·26
Anterior palatine foramina	·35	·30
Incisors to 1st upper molars	·44	·44
Breadth of interparietal	·45	·41

The proportions of the two skulls would thus seem to be almost exactly the same, that of *M. blanfordi* having rather longer anterior palatine foramina, and broader interparietal bones. The following differences, however, form a ready means of distinguishing the skulls of the two species:—

In *M. rufescens* the fronto-parietal sutures form together a very obtuse angle forward, sometimes almost a straight line across the skull; but in *M. blanfordi* they form but little more than a right angle, the frontal extending in the middle line much further backwards between the parietals.

The shape of the interparietal bone is very different in the two skulls. In *M. rufescens* it is more or less five- or six-sided, with the angles well developed; but in *M. blanfordi* the bone, as may be seen in the figure, has only two distinct angles, namely those at the outer ends of the bone, its front and back edges being simple curves.

In the above-mentioned points the two skulls of *M. blanfordi* both agree perfectly; but one of the characters mentioned in the original description is now found to be a question of age. This is the shape of the front edge of the anterior zygoma-root, which was said to be slanting instead of perpendicular. The older skull, however, has this edge quite upright, as in other Rats; and I have therefore had

¹ This term is here used instead of the more correct form *Mus alexandrinus*, var. *rufescens*, as being more convenient for ordinary use.

² From the condyles to the most anterior point of the actual bone.

the lateral view of the skull (Plate LI. fig 4) redrawn from the adult specimen, in order that the properly developed form might be shown. The figure of this species (Plate L.) is taken from the immature specimen. There are, however, scarcely any extreme differences between the two individuals, except that of size.

The teeth of *M. blanfordi* seem to be somewhat broader than in *M. alexandrinus*; and in this respect they resemble those of *M. mettada*.

11. MUS URBANUS.

**Mus musculus*, Ell. Madr. Journ. x. p. 214 (1839).

**Mus nepalensis*, Hodgs. J. A. S. B. x. p. 915 (sine descr.) (1841).

**Mus manei*, Gray, Cat. Mamm. B. M. p. 111 (sine descr.) (1843).

**Mus urbanus*, Hodgs. Ann. & Mag. N. H. xv. p. 269 (1845).

**Mus dubius*, Hodgs. t. c. p. 268 (1845).

**Mus homourus*, Hodgs. t. c. p. 268 (1845).

**Mus darjeelingensis*, Hodgs. op. cit. iii. p. 203 (1849) (sine descr.); Horsf. Cat Mus. E. I. C. p. 143 (descr. orig.) (1851).

Mus tytleri, Blyth, J. A. S. B. xxviii. p. 296 (1859).

**Mus rama*, Cant., Blyth, J. A. S. B. xxxiv. pt. 2, p. 194 (1865).

Hab. The whole of India, in houses. Malacca (*Cantor*).

Fur short, crisp, quite spineless. General colour varying from bright fawn to dark rufous-brown; belly but little lighter, never white as in *M. bactrianus*. Hairs all over the body slate-coloured for three fourths of their length; then follows a yellow or orange-coloured tip. On the back there is a certain admixture of black-tipped hairs, which, however, are absent in the brighter-coloured specimens. Tail generally decidedly longer than the head and body, sometimes only just about equal, brown, more or less paler beneath. Ears short, rounded. Mammæ 10, three pectoral and two inguinal pairs. Cæcum of medium length and not very markedly curled round, 0.56 in. long in an adult male.

Dimensions.

	Nepal (<i>Hodgson</i>).		Darjiling (<i>Blanford</i>).	Ceylon.
	<i>a.</i> ♂.	<i>b.</i> ♀.	<i>c.</i> ♂.	<i>d.</i> ♀.
Head and body	2.6	3.0	3.05	3.0
Tail	3.27	3.23	3.20	3.54
Hind foot . . . . .	.65	.67	.69	.68
Forearm and hand . . . .	.74	.80	.80	.79
Ear-conch, length . . . .	.40	.40	.45	.43
Muzzle to ear . . . . .	.67	.75	.76	.76

This species, to which such a large number of names have been given, seems to be the common house-mouse of the whole of India and even of Malacca, as the *Mus rama*, Cant., of Blyth is undoubtedly referable to it, as proved by the type. Blyth and, following him, Jerdon considered that there were at least two species of house-mouse in India—the one, *Mus homourus*, Hodgs., being that of the Himalayan region, and the other, *M. urbanus*, that of the plains;

but I can find no difference of any importance between the Mice of Darjiling and Katmandu and those of Southern India. Of course, as might be expected, specimens from the hills have rather longer and softer fur and darker coloration than those of the plains; but this is only a parallel case to that of *Mus alexandrinus*, which, as shown above, becomes redder and coarser-haired the further south it lives.

With regard to the distinctness of *M. urbanus* from *M. musculus*, Blyth said that "*M. musculus* has conspicuously larger ears, much smaller eyes, broader paws, and the tail is one fourth shorter, measuring 3 inches in *musculus* and 4 in *urbanus*. The fur, again, is of very different texture." Now I am by no means so satisfied of the distinction of these two forms as Blyth seems to have been. *M. urbanus*, it is true, has on the average somewhat smaller ears; but the difference is extremely small, and the measurements intergrade completely. The stated difference in the size of the eyes must have come solely from the manner of preservation of the specimens compared; probably Blyth's *urbanus* was fresh, while his *musculus* was in spirit, which would quite account for the difference. As to the lengths of the tail, 3 and 4 inches respectively, I can only say that I have never seen a spirit-specimen of *urbanus* with the tail more than 3.5 inches, the average being considerably less; and many specimens of *musculus* have it from 3.2 to 3.4 inches; so that we see that, as far as regards the more essential characters of the dimensions of the members, the two forms cannot possibly be separated. However, the fur in *urbanus* is always much shorter, and the colour much paler than in *musculus*; so that specimens can always be placed without difficulty under one or other heading; and therefore I provisionally retain *M. urbanus* as a good species, its most marked distinctive characters being its fawn or reddish coloration and its short crisp fur.

I do not think it is necessary to discuss the names put as synonyms in detail: the types of all of them except *M. tytleri* are in the British Museum; and I have not the smallest doubt in the case of any one of these. The type of *Mus rama* from Malacca is of quite the usual character, and might almost have belonged to the same litter as that of *M. manei* from Madras.

With regard to *M. tytleri*, we have a specimen, also from the Dehra Doon, which fairly answers to Blyth's description, and which I assign to this species. It is the very palest specimen I have seen, quite as pale as *M. bactrianus*; but its belly is scarcely lighter than its back, while that of *M. bactrianus* is pure white. Moreover we have a similarly pale specimen from Calcutta. Dr. Anderson tells me that the type of *M. tytleri* is not in the Calcutta Museum; so that we have only Blyth's description to go upon; I think, however, that I am correct in referring it to *Mus urbanus*.

Mus sublimis, W. Blanf.¹, seems to be allied to this species; but without seeing specimens I cannot express any opinion as to its

¹ Zool. Yarkand Exp., Mamm. p. 51, 1879.

position. The type, and only known specimen, was obtained at Tankse, Pankong Lake, Ladak, at a height of 13,000 feet.

12. MUS BACTRIANUS.

**M. bactrianus*, Blyth, J. A. S. B. xv. p. 140 (1846); Blanford, Zool. East Pers. i. p. 56, pl. v. fig. 2 (1876); Danf. & Alst. P. Z. S. 1880, p. 61.

M. gerbillinus, Blyth, J. A. S. B. xxii. p. 410 (1853); Cat Mus. As. Soc. p. 119 (1863).

M. theobaldi, Blyth, J. A. S. B. xxii. p. 583 (1853).

Hab. N.W. India and Cashmere, and westwards to the Euphrates (*Danford and Alston*); Palestine (*Brit. Mus., Tristram*); Muscat, Arabia (*Blanford*).

Fur rather short and crisp; above sandy fawn, the bases of the hairs slate-colour; below usually pure white, but with sometimes a slight basal tinge of slate, especially in immature specimens. Ears rather shorter than in *M. urbanus*, covered inside and out with sandy-brown hairs. Tail about the length of the head and body, or as a rule rather longer, brown above and white beneath, the difference, however, not being strongly marked. Cæcum simple, about 0·7 inch long. Mammæ 10, three pectoral and two inguinal pairs.

The type has a more reddish coloration than usual on the upper side; but otherwise it is similar to Persian and Syrian specimens.

The skull presents no characters worthy of remark, being almost exactly like that of *Mus musculus*. In immature specimens it is much more convex above than it is later, and the nasal region is shorter.

Dimensions.

	Baluchistan.	Karachi.	Palestine.	Sind.
	a. ♂.	b. ♂.	c. ♀.	d. imm. ♂.
Head and body	3·4 ¹	2·40	2·70	2·0
Tail	3·55	3·23	2·90	2·45
Hind foot	·75	·66	·65	·65
Tibia ²	·92	·73	·75	·63
Forearm and hand	·90	·73	·75	·69
Ear-conch, length	·47	·40	·45	·34
Muzzle to ear . . . . .	..	·70	·73	·62

This species is always readily distinguishable from other Indian Mice by its pale colour and white belly. It would appear to be a true desert form, having the coloration peculiar to the inhabitants of sandy plains and being found only in districts where such plains form a large part of the country.

Messrs. Danford and Alston (*l. c.*) give the dimensions of two spirit-specimens taken at Oroul on the Euphrates; but I should imagine that there has been some misprint among the figures, as I

¹ Skull extracted.

² From the *upper* side of the knee-joint to the sole.

have never seen a specimen, preserved in spirit, in which the tail was considerably shorter than the head and body, as it is there stated to be. One of this very series, moreover, is in the British Museum; but it is only a much stretched skin, in which, nevertheless, the tail is but little shorter than the head and body.

It will be seen by the table of measurements that in all the adult specimens the hind foot is considerably shorter than the tibia, but in an immature specimen (*d*) it is longer. This difference, combined with the more dusky belly and more convex skull, inclined me at first to consider this Sind specimen, and another quite agreeing with it from Muscat, a distinct species; but I now believe that these differences are only due to immaturity. It is true that in both specimens all the molars are fully grown up into their places; but they are not worn at all, as are those of the other specimens measured.

13. MUS CERVICOLOR.

**Mus cervicolor*, Hodgs. Ann. & Mag. N. H. xv. p. 268 (1845).

M. strophiatatus, Hodgs. loc. cit. (1845).

?*M. albidiventris*, Blyth, J. A. S. B. xxi. p. 351 (1852).

Hab. Nepal; Calcutta¹ (*Blyth*).

"Abundant in cultivated fields of the valley of Nepal" (*Hodgson*).

Fur above and below slate-coloured for three fourths of its length, the tips being above pale fawn, quite hiding the slate, and below white. Ears rather large, rounded, covered on both sides with very short shining hairs. Tail usually about equal to the body alone, without the head, by which character this species may be readily distinguished from all other Indian Mice, with the exception of *M. (Leggada) buduga* (q. v.). Cæcum short, pouch-like, bent round upon itself. Mammæ 10, three pectoral and two inguinal pairs.

The skull, viewed from the side, seems to be more flattened than usual in the frontal and nasal regions. On the whole it is similar to that of *M. (L.) buduga*; but this flattening is much more strongly marked in *M. cervicolor*, *L. buduga* having a distinct convexity of the outline just in front of the orbits.

Dimensions.

	Nepal (<i>Hodgson</i>).	
	a. ♂.	b. ♀.
Head and body	2·9	2·9
Tail	2·8	2·65
Hind foot	·65	·64
Forearm and hand	·80	·80
Ear-conch, length	·45	·49
Muzzle to ear	·82	·80

¹ ? *Leggada buduga*, Gr.

This species seems to be most nearly allied to *Leggada buduga*, Gr., the description of which (p. 553) should be carefully examined before any specimen is set down as the present form, which is much rarer and apparently almost confined to Nepal and the neighbouring region.

With regard to the identity of *Mus strophiatatus* with this species I think there can be but little doubt. Hodgson's drawing of *M. cervicolor* represents two specimens, with the following notes attached:—"Male's colour darker and duller, female's lighter and purer." This distinction, which Hodgson, when the drawing was done, thought to be sexual, he later founded *M. strophiatatus* upon, as there is a second note on the same drawing to the following effect: "There are two species, 1st, duller hued and ungorgetted; 2nd, brighter and gorgetted." This "gorget" is merely the extension upwards on the neck of the light breast-colour, a character of no value whatever, as far as I can judge by the specimens presented by him; and the difference in brightness seems to be very slight. We have not any specimens named *M. strophiatatus*; but one of those sent as *cervicolor* agrees very fairly with his figure and description of that animal.

Mus albidiventris was referred to this species by Blyth himself in his memoir; it seems possible, however, that it is another synonym of *M. buduga*, which is very closely related to this species, and which is more likely to be found in Calcutta.

It is very probable that *M. cunicularis*, Blyth¹, from the Khasi Hills, is a synonym of *M. cervicolor*, the description agreeing very fairly, though the colour would seem to be somewhat darker; this, however, can only be settled by a reference to the types.

14. MUS ARIANUS.

Mus sylvaticus, L., De Fil. Viagg. Pers. p. 344 (1865).

**Mus erythronotus*, W. Blanf. Ann. & Mag. N. H. (4) xvi. p. 311 (1875); East Pers. ii. p. 54, pl. v. fig. 3 (1876); Zool. Yark. Exp. Mamm. p. 54 (1879), nec Temm. Faun. Japon. Mamm. p. 50 (1850).

**M. arianus*, W. Blanf. Ann. & Mag. N. H. (5) vii. p. 162 (1881).

Hab. Eastern Persia (*Blanford*), Gilgit, Cashmere (*Scully*), Kashghar and Wakhan (*Stoliczka*).

Fur soft, without spines; above dark red, the basal three fourths of the hair dark slate-colour. Belly white. Mammæ 6, one pectoral and two inguinal pairs. Tail slightly longer than the head and body, brown above, white beneath. Ears long; laid forward they reach quite to the eye. Cæcum quite simple and rather long, measuring 1.3 inch in specimen *a*.

¹ J. A. S. B. xxiv. p. 721 (1855).

Measurements.

	Types, Kohrud, Persia ¹ .		Gilgit (<i>Dr. Scully</i>).		
	<i>a.</i> ♂ in.	<i>b.</i> ♀ in.	<i>c.</i> ♂ in.	<i>d.</i> ♀ in.	<i>e.</i> ♀ in.
Head and body	3·6	(<i>c</i>) 3·5	3·55	3·40	3·67
Tail	4·0	3·9	4·05	3·95	4·1
Hind foot	(²)	·82	·86	·82	·84
Forearm and hand	·95	·94	·98	·95	·96
Ear-conch, length...	·55	·53	·54	·54	·54
Muzzle to ear	(<i>c</i>) ·89	.....	·90	·90	·92

This species is so very closely allied to the common *Mus sylvaticus*, L., that I think it is extremely doubtful whether it is more than a variety of that species. The external characters (size, colour, and proportions), with one exception, are identical with those of English specimens of *M. sylvaticus*; the one exception is the length of the hind foot, which in *M. sylvaticus* is remarkably long, much more so than is usual among the species of restricted *Mus*, while in *M. arianus* this part is only of normal length. Thus, the hind foot of true *M. sylvaticus* is distinctly longer than the distance between the muzzle and ear, while, as shown by the measurements given above, that of *M. arianus* is always shorter. The following are these two measurements in five English specimens of *M. sylvaticus* :—

Hind foot	·90	·88	·90	·87	·85
Muzzle to ear ..	·86	·81	·84	·84	·77

These dimensions show that, in English individuals at least, the comparative proportions of the hind foot are very different from those of *M. arianus*; but I have not been able to examine any properly-preserved specimens from intermediate localities, so that I cannot give a definite opinion as to the constancy of this character.

With regard to the skull, Mr. Blandford, in his Zoology of the Yarkand Mission, has discussed the question of the relationships of these two forms. He there states that in *M. arianus* the occipital portion of the skull is lower, as also is the foramen magnum, the opening of the posterior nares is broader, and the last upper molar is larger than in *M. sylvaticus*. On comparing the typical skull of *M. arianus* with a series of skulls of *M. sylvaticus*, I find that a Lanarkshire specimen has a lower occipital region, and that of several British specimens some have higher and some lower occipital foramina. With regard to the other characters certain specimens approach *M. arianus* very closely, though none quite equal it.

¹ The dimensions given by Mr. Blandford, being those of the specimens when fresh, are not suitable for comparison with those of specimens preserved in spirit. I have therefore re-measured the types in the British Museum.

² The hind feet of this specimen have been broken. Mr. Blandford gives their length as ·9; but this, I believe, includes the claws, though he unfortunately does not mention whether it is so or not.

After describing these differences, Mr. Blanford himself says:—
“It is, however, by no means improbable that *M. erythronotus* (*M. arianus*) is merely a local race of *M. sylvaticus*; and, with a good series of specimens from various localities, the two might be found to pass into each other.”

On the whole I think that *M. arianus* will be found to represent a short-footed eastern variety of *M. sylvaticus* worthy of a varietal name, but not distinct enough to merit specific separation.

De Filippi's "*Mus sylvaticus*, L." is no doubt this short-footed form, and not the true European *M. sylvaticus*.

This species is really a Palæarctic and not an Oriental form. It only just crosses the extreme northern limits of our region, the only Indian locality for it being Gilgit, North Cashmere, where Dr. Scully obtained several specimens.

15. *MUS NITIDULUS*.

Mus nitidulus, Blyth, J. A. S. B. xxviii. p. 294 (1859).

Hab. Schwe Gyen, Sitang R., Pegu (*Berdmore*); Darjiling (*Blanford*); Sikkim, "mountains 4500 feet" (*Argent*).

Fur long, sometimes spiny, dark slate-colour for nine tenths of its length, then yellowish grey, with the extreme tips black. Tail slightly longer than the head and body, brown above and white below. Hind foot much longer than in *M. urbanus*, exceeding the distance between the muzzle and the ear, as in true *M. sylvaticus*, L. (see p. 549). Skull with the front edge of the outer wall of the infraorbital foramen strongly slanting¹ (Plate LI. fig. 8), all the other Indian species, when adult, having this edge perpendicular, or even curving beyond its base. Cæcum short, 0·52 inch in length.

The following are the dimensions of our only spirit-specimen, an adult female, in which, however, I cannot make out the number of mammæ:—Head and body 3·0, tail 3·58, hind foot ·80, forearm and hand ·88, ear-conch length ·50, nose to ear ·77.

This species, to which I refer two of our Indian Mice, was described by Blyth from Pegu; he did not mention the peculiarity of the wall of the infraorbital foramen; but the description of the external characters agrees very closely.

Our two specimens of this species present another example of the uselessness, as a specific character, of the presence or absence of spines in the fur—one of them, the specimen measured, having its fur rather soft, and almost entirely spineless, while the other has its fur nearly wholly composed of spines, quite as much as in average specimens of *Leggada platythrix*.

16. *MUS METTADA*, Gr.

**Golunda mettada*, Gray, Charlesw. Mag. N. H. i. p. 586 (1837).

**Mus lanuginosus*, Ell. Madr. Journ. Lit. Sci. x. p. 212 (1839).

¹ This same peculiarity in *M. blanfordi* was found to be due to immaturity; but in this species it appears to be an adult character, as both of the above-mentioned specimens are not only full-grown, but even aged, their teeth being quite worn down.

Mus mettada, Blanford, J. A. S. B. xlv. (2) p. 290, pl. i. (skull, foot, &c.) (1877).

“*Metád*” of Tank-diggers.

Hab. Madras Presidency.

Fur long, soft, and spineless. General colour above grey, below white. Hairs above dark slate-colour for seven eighths of their length, then yellowish white, the extreme tips black or dark brown; some have all the distal quarter of the hair black; these darker hairs, as usual, are more numerous along the centre of the back. Belly-hairs slate-colour for their basal three fourths; the tips white, hiding the slate. The line of separation between the upper and lower colours, as a rule, is not well marked.

Mammæ 8, two pectoral and two inguinal pairs. Tail about the length of the head and body, varying, in our specimens, from a $\frac{1}{4}$ of an inch longer to $\frac{1}{2}$ an inch shorter. Hairs on the tail numerous, rather longer than in most other species, but not forming a pencil at the tip; colour brown above and white below. Ears large, rounded, clothed inside and out with short shining hairs. Feet white or pale brown. Cæcum wide and rather short, measuring just an inch in the only specimen (an adult male) in which it has been preserved. The skull has been so well figured and described by Mr. Blanford (*l. c.*) that there is no need for me to enter into any details concerning it.

Dimensions.

	Ahmednagar.	Madras.
	<i>a.</i> ♂	<i>b.</i> ♂.
Head and body	4·5	4·56
Tail	4·2	4·70
Hind foot	1·0	1·05
Forearm and hand . .	1·25	1·30
Ear-conch, length . . .	·60	·60
Nose to ear	1·15	1·15

There are, as usual, five pads on the fore feet; but on the hind feet a most remarkable difference is observable. All other species of the genus that I have ever seen, have six well-defined pads, the last always strongly marked, linear in the Rats and circular in the Mice; but in this species the sixth pad is always, and the fifth frequently, suppressed. Of eight spirit-specimens that I have examined, three have only four, with the position of the fifth very faintly indicated in one of them; the other five (the specimens from Ahmednagar referred to in Mr. Blanford's paper) have five well-defined circular pads. In one of these last there is an extremely faint indication of the normal sixth pad; but so faint is it that a lens is needed to make out its limits at all.

This suppression of the hinder foot-pads is, judging from analogy, most probably owing to the *Metád*'s habitually moving and sitting, more or less, like a *Jerboa*, because we find that, in all genera doing this, the foot-pads are either suppressed behind or

crowded together in the front part of the sole. The extreme of this suppression is represented by the Common Jerboa (*Dipus jaculus*), which has only one hind foot-pad; *Gerbillus* has four, all close together at the roots of the toes; and *Zapus* (the North-American "Jumping-Mouse") has five. The members of these genera are all well known constantly to rest on the front part of the hind foot, and not to be in any way plantigrade, as are the Muridæ with six well-developed hind foot-pads; we are therefore, I think, justified in considering the *Metád* as showing the commencement of a similar differentiation, which, however, has not gone nearly so far as in the others. *Mus blanfordi* has its foot-pads rather crowded together in the front of the foot; so that it is possibly also rather less plantigrade than usual.

As to the affinities of this animal (which seems to be somewhat isolated from the other Indian species), it may be seen by the synopsis on p. 531, that the only character, apart from size, by which to separate the Rats from the Mice is the very different shape of the sixth hind foot-pad; and therefore the rudiment of this pad, mentioned above as occurring in one of our specimens, will be of service to us. This rudiment is very nearly circular; and therefore, as far as we can rely on any one character, even though nearly universal in its application, we may, for the present, consider *Mus mettada* a large Mouse rather than a small Rat.

Subgenus LEGGADA.

Leggada, Gray, Charlesw. Mag. N. H. i. p. 586 (1837).

Nannomys, Peters, Monatsb. Acad. Berl. p. 480 (1876).

First upper molars with an extra cusp on their front edge (see Plate LI. figs. 10, 11). Fur more or less spiny.

Hab. India and Africa.

This subgenus was founded by Gray on his *Leggada buduga*, and was also stated to include Bennett's *Mus platythrix*. It has hitherto been considered to be confined to India; but Dr. Peters's careful description of his subgenus *Nannomys* shows most conclusively that it is identical with *Leggada*; in fact, his characters are the very same as Dr. Gray's, except that he lays rather more stress on the presence of spines in the fur.

The types of *Mus minutoides*, Smith¹, from South Africa, preserved in the British Museum, certainly belong to this subgenus; and so, with Dr. Peters's two species, *M. minimus*² from Mozambique, and *M. setulosus*³ from the Cameroons, we have three species of *Leggada* recorded from Africa; and there is no doubt that more still remain to be described when that continent is further explored. Some of the African species already described will probably also turn out to be members of this subgenus.

The presence of this form in Africa was quite to be expected,

¹ S. Afr. Quart. Journ. ii. p. 157 (1835).

² Reise nach Mossambique, p. 153 (1852).

³ Monatsb. Ak. Berl. 1876, p. 480.

considering the large number of murine types common to the Ethiopian region and the peninsula of India.

The only Indian species certainly belonging to this subgenus are the two following :—

17. MUS (LEGGADA) PLATYTHRIX.

**Mus platythrrix*, Benn. P. Z. S. 1832, p. 121 (1832).

Leggada platythrrix, Gray, Charlesw. Mag. N. H. i. p. 586 (1837).

Hab. The peninsula of India, south of the Nerbudda.

Fur above and below composed almost entirely of flattened spines. General colour sandy brown above, white below, the line of demarcation well-defined. Above, the hairs and spines are pale slate-coloured for about half their length; there is then a subterminal ring of yellow, gradually darkening to the extreme tip, which is nearly black. Ears short, rounded, slate-coloured. Tail only the length of the body without the head; covered above with brown, and below with white hairs. Mammæ 10, three pectoral and two inguinal pairs. Hind feet short, with six pads, which are all small and circular (Plate LI. fig. 12). The type, as is shown by the measurements given below, has a considerably longer tail than any other specimen that I have seen, but is otherwise similar to the rest. Skull with the anterior palatine foramina very long, extending to the middle of the first molar; anterior edge of the zygoma-root perpendicular.

For measurements, see Table, p. 556.

This species is a well-marked form, and cannot be confounded with any other. It always possesses the extra cusps to the front upper molars characteristic of the subgenus, while, as mentioned below, *L. buduga* is frequently without them. Sir Walter Elliot (*l. c.*) has given a full account of its manner of life, which seems to be entirely that of a burrowing animal.

The other Indian *Leggada* is far smaller, and has not by any means such a simple history, having been given several different names, as may be seen by the following synonymy.

18. MUS (LEGGADA) BUDUGA.

**Leggada booduga*, Gray, Charlesw. Mag. N. H. i. p. 586 (1837).

**Mus lepidus*, Ell. Madr. Journ. Lit. & Sci. x. p. 216 (1839).

Leggada lepida, Blyth, J. A. S. B. xxxii. p. 350 (1863).

Mus terricolor, Blyth, J. A. S. B. xx. p. 172 (1851).

Mus fulvidiventris et ?*M. albidiventris*, Blyth, J. A. S. B. xxi. p. 351 (1852).

**Mus beavani*, Peters, P. Z. S. 1866, p. 559 (1866).

"*Buduga*" of the tank-diggers, *fide* Elliot *l. c.*

Hab. Continental India, south of the Ganges and Indus, and Ceylon.

Fur rather short and crisp, sometimes mixed with very fine flattened spines, sometimes quite without them. Colour above pale

sandy brown, the basal halves of the hairs slate-colour. Below, the hairs are pure white, sometimes quite to their roots; sometimes the basal halves are slate-colour; and there is every stage between the two. Tail generally nearly equal to the head and body, rarely just exceeding them, covered with hairs which are much shorter than in *L. platythrix*. Mammæ 10, three pectoral and two inguinal pairs. Hind foot-pads six, small, circular. Ears small, oval; laid forward they just reach to the eye. Cæcum short and pouch-like.

For measurements see Table, p. 556.

In this species we find the link which, by way of *Mus cervicolor*, bridges over the space between *Leggada* and *Mus*. *L. platythrix* is strongly differentiated, and always shows clearly the extra cusp on the upper molar; but in many specimens of *L. buduga* this cusp is not distinguishable, and these specimens are barely separable specifically from *Mus cervicolor*. Almost the only character to distinguish them is the different length of the ear-conch, which varies from 0·41 to 0·49 inch in *M. cervicolor*, and from 0·32 to 0·39 in *L. buduga*. The colours and other proportions are very similar; and it seems very probable that we shall yet obtain intermediate specimens from the region where the ranges of the two species approximate—namely, in the valley of the Ganges, which seems at present to be the dividing line between the two forms.

With regard to the name which must stand for this species, it unfortunately happens that Gray's barbarous term "*booduga*" antedates Elliot's name *lepida* by two years. We cannot ignore the name *booduga* as barbarous without also doing the same in the case of the *Metád*, which was called *M. mettada* by Gray and *M. lanuginosus* by Elliot in the same papers in which this species received its two names. I have therefore done what Mr. Blanford did with regard to *M. mettada*¹—namely, correct Gray's erroneous spelling of the native name, and then use it provisionally until some final understanding is come to with regard to the use of barbarous words as specific names.

Mus beavani, Peters, of which the Museum possesses two immature individuals of the typical series, is quite undistinguishable from this species. Our specimens show distinctly the extra cusps on the upper molars; and the proportions are quite the same. The species was described from specimens brought from Maunbhoom by Lieut. Beavan, and would appear to be the true *Mus terricolor*, Blyth, which is said to be "the most common field- and garden-mouse in Lower Bengal." With regard to the specific distinction of this last species, Blyth says:—"This much resembles *M. lepidus*, Ell., in form and colour, but the face is very much shorter, and the fur short, soft, and not spinous in the least degree."

We have seen, by many instances, how utterly valueless the character of the presence or absence of spines is; and in this species, even when well developed, they are by no means stout or conspicuous; and, as far as regards the shortness of the face, I have been quite unable to perceive any thing of the sort in any of our spineless

¹ J. A. S. B. xlvi. p. 289 (1877).

Bengal specimens. Moreover Jerdon says¹:—"A specimen has been sent to Mr. Blyth by Walter Elliot from Southern India, along with a lot of *Mus lepidus*, from which he did not distinguish it." This, of course, is a strong confirmation of my opinion as to the identity of the two forms, since so acute an observer as Sir W. Elliot did not separate them, and they were found together in the same locality. The proportions given by Blyth are moreover precisely the same².

I have also but little doubt that Blyth's *M. fulvidiventris* is also a synonym of this species. When describing it Blyth stated that it was the "*Mus cervicolor*, Hodgs." of Kelaart. Now we have seen how closely allied *L. buduga* and *M. cervicolor* are; and some of our Ceylon specimens are extraordinarily similar externally to that species. Moreover there is nothing in Blyth's description to militate against this conclusion except the stated "rufescent or isabelline" colour of the belly. This tinge, however, may easily have been the result of the defective preservation of the type, a frequent cause of a more or less yellow instead of white coloration of fur. *M. albidiventris*, Blyth, described at the same time as *M. fulvidiventris*, was later considered by the describer to be a specimen of *M. cervicolor*; but I think it very possible that it may be this species, judging from its locality (Calcutta).

The drawing given of the teeth (Plate LI. fig. 10) has been taken from the actual specimen upon which Gray founded the genus *Leggada*. I have also (fig. 11) had a side view of the first molar of the same specimen taken, showing the extra cusp (*a*) in profile, and, for the sake of comparison, the side view of the same tooth of another equally spiny specimen, which has scarcely a trace of the extra cusp. These two figures show that there is no correspondence between the presence of spines in the fur and extra dental cusps. In fact, in the British-Museum series there are specimens (1) with both spines and extra cusps, (2) with spines and no extra cusps, (3) no spines, but distinct extra cusps, and (4) neither spines in the fur nor extra cusps on the molars.

This series seems to me quite to preclude the possibility of separating these variable Mice into two or more distinct species.

Blyth described two other species as belonging to *Leggada*, namely *L. spinulosa*³ and *L. jerdoni*. The latter is a good species of true *Mus*, and has been treated of already (p. 537). The former, however, I am quite unable to identify, though I believe it will turn out also to be a good species, unless *L. platythrix* should be found to occur in the Punjab, in which case it might be only a synonym of that species.

¹ Mamm. Ind. p. 209.

² Dr. Anderson has sent two specimens of the true *M. terricolor* from the neighbourhood of Calcutta, expressing at the same time his opinion that that species is distinct from *L. buduga*. These specimens, however, only confirm my opinion as to their identity, agreeing exactly in colour, and being nearly as spiny as the typical specimens of *L. buduga*.

³ J. A. S. B. xxiii. p. 734 (1854).

Table of Measurements.

	<i>Leggada platythrix.</i>			<i>L. buduga.</i>			<i>L. minutoides.</i>	
	Ad. ♂. Deccan (type).	Ad. ♂. S. India.	Ad. ♀. Madras.	Ad. ♂. Ceylon.	Ad. ♂. Madras.	Ad. ♀. Ajmere.	Dr. Smith's types. South Africa.	
	in.	in.	in.	in.	in.	in.	in.	in.
Length of head and body	3·3	3·45	3·3	2·8	2·5	2·45	2·15	2·09
" tail	3·0	2·55	2·63	2·45	2·45	2·53	1·77	1·75
" hind foot	·67	·70	·68	·65	·57	·57	·53	·52
" forearm and hand	·90	·92	·84	·76	·71	·65	·62	·61
" ear-conch.....	·39	·46	·45	·39	·38	·37	·31	·33
Breadth of ear-conch ...	·33	·41	·44	·35	·35	·32	·30	·32
Nose to ear	·89	·95	·93	·79	·66	·65	·59	·60

Subgenus VANDELEURIA.

Vandeleuria, Gray, Ann. & Mag. N. H. x. p. 265 (1842).

First and fifth toes on both fore and hind feet provided with a short nail instead of a claw (see Plate LI. fig. 13 & 13a). Tail very long.

There is only one undoubted species of this subgenus, of which the following is the synonymy:—

19. MUS (VANDELEURIA) OLERACEUS.

**Mus oleraceus*, Benn. P. Z. S. 1832, p. 121 (1832).

**Mus longicaudatus*, Ell. Madr. Journ. x. p. 94 (sine descr.) (1839).

Mus dumicolus, Hodgs. J. A. S. B. x. p. 915 (1841).

Vandeleuria oleraceus, Gray, Ann. & Mag. N. H. x. p. 265 (1842).

**Mus (Vandeleuria) dumeticola*, Hodgs. Ann. & Mag. N. H. xv. p. 268 (1845).

Mus povensis, Hodgs. op. cit. p. 269 (1845).

Mus (Vandeleuria) oleraceus, Anders. Zool. Yunn. Exp. p. 313 (1878).

Hab. Burmah, and all India from Nepal to Madras.

Fur above bright rufous, the roots of the hairs dark slate-colour; belly pure white. Mammæ 8, two pectoral and two inguinal pairs. Tail very much longer than the head and body. Hind foot and pads as shown in Plate LI. fig. 13. An upper view of the fifth toe, on a larger scale, is also given (fig. 13a) to show its very peculiar short nail. The cæcum is unusually large for such a small animal, measuring no less than 1·6 inch in an adult female, in which also the whole length of the intestine from pylorus to anus is just over 13 inches.

This is such a well-marked species, and Dr. Anderson (*l. c.*) has recently so well described it, that I need only give its chief dimensions, taken from the type specimen, an adult male in spirit, collected by Col. Sykes in the Deccan.



J.Sind lith.

Hanhart imp

MUS BLANFORDI